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SIZE-WEIGHT RELATIONSHIPS IN *BUFO REGULARIS* REUSS

By

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(*Received* 21/12/65)

Bufo regularis Reuss is widely distributed throughout the African continent south of the Sahara, but little information about its bionomics is available, apart from a paper by Winston (1955). According to Gadow (1909), West African specimens are small, measuring about 2 in. (5 cm.) in length, whilst those from the Cape are the largest and reach a length of 5-6 in. (12.5-15 cm.).

In West Africa, *B. regularis* is seldom seen in water. During the rainy season, toads are found on open ground and are most active at night: during the dry season, they usually hibernate in small holes in the ground, in hollow tree trunks, or amongst dense vegetation. Pairing toads may be found on the ground and presumably make their way to water, the male carried astride the back of the female clasping her with his arms. The eggs are small, spherical bodies about 1.5-2.0 mm. in diameter with the animal pole pigmented black, the vegetable pole creamy white. They are arranged in a string held together by a tubular sheath of jelly which swells in water and forms a protection from enemies and mechanical injury. An early neurula stage is reached soon after fertilization and within 24 hours some eggs escape from their coat of jelly as late neurulae. The external gills disappear after 4 days and metamorphosis occurs within 10 weeks (Webb, 1958).

In the northern Sudan, *B. regularis* breeds in irrigation ditches and in temporary rainpools of the desert just beyond the cultivated area fringing the Nile. Development of the eggs is extremely rapid, no doubt an adaptation to a short rainy season (Cloudsley-Thompson & Chadwick, 1964). Although some breeding may take place throughout the year, certainly most of it occurs during the period of the rains, from July to September each year.

Apart from a recent study on the diurnal rhythm, temperature and water relations of *B. regularis* (Cloudsley-Thompson, 1967) and the papers quoted above, there appears to be a general lack of information about this very common species. In order to investigate its size-weight relationships therefore, measurements were made on 100 toads of both sexes collected at random in July 1965, at the beginning of the breeding season. The animals were weighed with a sensitive balance and two linear measurements taken by means of calipers, viz.—snout to vent (body length) and maximum head width at the angle of the jaws (head width). The results expressed graphically in Figs. 1 and 2 show clear relationships between the three parameters. The fact that the points on the graphs do not fall into two separate groups indicates that, although females are usually larger than males, their size-weight relationships are similar.

The average weight was around 15-20 gm., the average body length 5.5-6.0 cm. and head width 2.0-2.3 cm. These figures compare with a mean weight of about 60 gm. and body length of 8.0-9.0 cm. in 83 male toads studied by Winston (1955), and therefore disprove Gadow's (1909) statement that West African specimens of *B. regularis* are smaller than those from other parts of the continent.

My thanks are due to Dr. J. F. D. Frazer for suggesting this problem and to Dr. A. Bellairs for reading the manuscript.

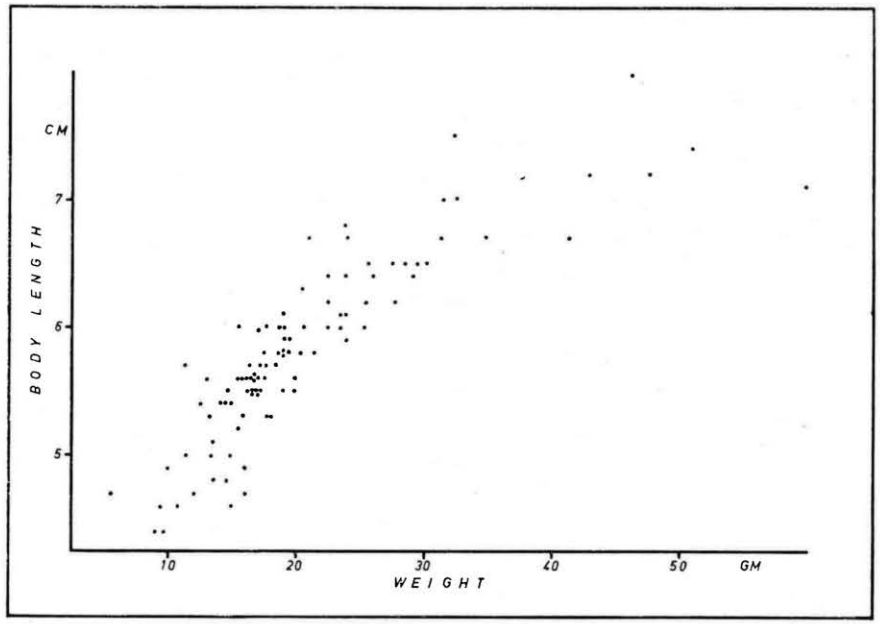

Fig. 1. Relationship between body length and weight in *B. regularis*.

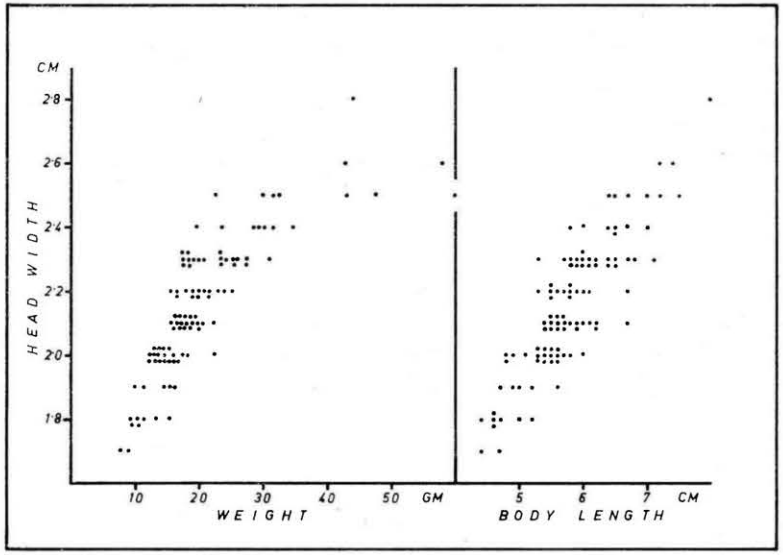

Fig. 2. Relationship between head width and weight and body length in *B. regularis*.

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WATER-RELATIONS AND DIURNAL RHYTHM OF ACTIVITY IN THE YOUNG NILE MONITOR

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(*Received* 25/5/66)

INTRODUCTION

The Nile monitor lizard *Varanus niloticus* (L.) is widespread throughout South and tropical Africa, extending northwards along the Nile into Egypt (Flower, 1933). In Sudan it is commonly found along the banks of the White, Blue and main Nile rivers and, according to Mathiasson (1964), may be regarded as a relict from the last pluvial period. The *Oxford English Dictionary* (1933) gives it the obsolete names 'worral', which is the same as the Arabic, and 'varan'. Cowles (1959) states that, in Natal, *V. niloticus* lays its eggs in termite mounds but, in the northern and central Sudan where these are absent, it is said to oviposit in holes scraped in the mud banks of irrigation canals and 'judwalls'. Most monitors become very tame when kept in captivity, even when captured as adults, but some individuals remain fierce and always lash their tails violently from side to side when anyone comes near them. This is mentioned by Flower (1933) and confirmed by my own observations on the larger specimens which, from time to time, are brought into the laboratory.

MATERIAL

The work described below has been carried out on three young *V. niloticus* collected during August, 1965. Their overall lengths at the time of capture were only 39 cm., 35 cm., and 33 cm.; consequently they were sufficiently small to be kept in glass aquaria in the laboratory. They took readily to captivity, only the smallest specimen lashing with its tail when handled. The monitors were housed singly or together in glass aquaria filled with water to a depth of about 5 cm. and containing a flat rock on to which they could climb. Most of their time appeared to be spent in the water, but occasionally they would lie out on the rock. They ate readily, especially during the warm weather, and were fed on live cockroaches and grasshoppers from which the hind legs had been removed.

WATER-RELATIONS

The water metabolism of reptiles has been reviewed recently by Chew (1961) with respect to deserticolous forms, but all lizard species seem to be well adjusted to life on dry land. A relatively impermeable skin prevents loss of water by evaporation except through the lungs. Urinary wastes are eliminated as a pulpy, semi-solid mass predominantly of uric acid with little accompanying water-loss, while a carnivorous diet supplements water-intake.

Water-loss

In order to measure the rate of water-loss in dry, still air, the monitors were weighed on a sensitive balance and placed in desiccators over anhydrous calcium chloride at room temperature (34° ±1°C. range) during October, 1965. After three days, the animals were beginning to look somewhat emaciated and the experiments were terminated. The results obtained are given in Table I from which it can be seen that the mean rate of water-loss over the three days was nearly 6 per cent per 24 hours. This figure is above that of water-loss under similar conditions from the skink *Mabuya quinquetaeniatus* (Lichtenstein) which averages about 5 per cent per 24 hours, and very considerably higher than that of the gecko *Tarentola annularis* (L. Geoffroy) (Cloudsley-Thompson, 1965). In view of the fact that the monitors were a good deal heavier than the skinks and geckoes, this represents a very much higher rate of transpiration.

Table 1

	1	2	3
Initial wt. (gm.)	22.51	37.53	38.90
Wt. loss during first day (gm./hr.)	0.058	0.130	0.123
Per cent	6.2	6.9	7.6
Wt. loss during second day (gm./hr.)	0.068	0.077	0.071
Per cent*	7.7	5.3	4.3
Wt. loss during third day (gm./hr.)	0.067	0.062	0.043
Per cent*	8.2	4.5	3.0
Per cent of original wt. loss in three days	22.2	16.1	14.1

*Per cent of weight at the beginning of each 24-hour period, not percentage of original weight.

Table 1. Water-loss in dry still air at room temperatures (34±1°C. range) from three Nile monitor lizards over a period of three days.

Water-uptake

In order to determine their mode of water-uptake, the monitors were desiccated in dry, still air as before. They were then placed on damp filter paper for 30 min, but no increase in weight occurred unless the animals were allowed to drink, which they did readily when given water. This shows that there is no water-uptake through the skin as occurs in amphibians, and some reptiles, e.g. *Moloch horridus* and worm-lizards (*Rhineura floridana* and *Anniella pulchra*) (Chew, 1961).

In order to determine whether water-balance could be maintained on a purely insectivorous diet without additional water, even during the coldest season of the year, a 'worral' was placed in a dry cage with unlimited food at room temperature (26° ±1°C. range) and relative humidity (30-35 per cent) during January 1966. Although several cockroaches were eaten, the monitor, whose weight at the beginning of the experiment was 29.60gm., lost an average of 0.85gm. daily. After four days it was beginning to become emaciated and the experiment was terminated.

It is clear from these results that, like most other reptiles (Chew, 1961), *V. niloticus* depends upon drinking for rehydration.

DIURNAL RHYTHM

Diurnal or circadian rhythms of activity have been described in a number of reptile species (Cloudsley-Thompson, 1961; 1965), the majority of which appear to be diurnal in habit, seeking their prey during the hottest part of the day, and nocturnal activity takes place only in warm weather. The Nile crocodile, however, shows a periodicity of locomotory activity with a peak in the early hours of the evening (Cloudsley-Thompson, 1964). Mathiasson (1964) observed in Nubia that *Varanus niloticus* and *Crocodilus niloticus* tended to bask during the period of 2-3 hours before and after noon, but no experiments appear ever to have been carried out on the diurnal rhythms of activity of Nile monitor lizards.

Method

As in the case of the Nile crocodile, activity was measured by means of a simple aktograph apparatus (Cloudsley-Thompson, 1964). This consisted of a corked tube,

partially filled with water, which acted as a float in the aquarium and was connected by a thread to a gymbal lever writing on a clockwork kymograph drum revolving once per week. Distinct movements of the monitor lizards in the water resulted in vertical strokes on the smoke record which were analysed over 3-hour periods and plotted as block histograms (Fig. 1, Nos. 1-6). During these experiments, the temperature and relative humidity of the air in the laboratory were noted by means of a recording thermo-hygrograph but, as already mentioned, the monitors spent most of the time in the water, where nearly all their activity took place. When they climbed onto the rock they merely lay there without moving. For experiments on the persistence of the rhythm in constant artificial illumination (100 Weston Master IV units), the entire set-up was placed inside a refrigerator which, although not running, provided excellent insulation from daily temperature fluctuations.

Results

Fig. 1 Nos. 1, 2 and 3, representing sections of much longer records, illustrate the diurnal rhythm of activity in each of the three individual monitors. From these it can be seen that their activity was almost entirely confined to the hours of daylight. Fig. 1 No. 4 is part of a record obtained from two monitors living together in the same aquarium. Although the level of activity is higher than that of the isolated animals, the pattern is similar. Fig. 1 Nos. 5 and 6 illustrate the persistent or endogenous nature of the rhythm, in two monitors living together at constant temperature and relative humidity in darkness (No. 5) and constant artificial illumination (No. 6).

The relative humidity was measured outside the aquarium: it was probably much higher just above the water.

The experiments from the records of which Fig. 1 Nos. 1, 2 and 3 have been selected, were carried out during the months of August, September and October, 1965, when the weather in Khartoum was quite warm with room temperatures around 30°-35°C. In order to determine whether there is any temperature-induced or seasonal shift in the time of activity of the Nile monitor, an experiment was run during a cold spell in February, 1966, when room temperatures fluctuated between 22° and 24°C. There was, however, no apparent difference between this record and those obtained during the warmer weather and it must be concluded that *V. niloticus* is diurnally active throughout the year and the rhythm does not become less marked during cooler weather as does that of the Nile crocodile (Cloudsley-Thompson, 1964).

DISCUSSION

The results of the experiments on the water-relations of *V. niloticus*, indicating its high rate of water-loss through transpiration when compared with that from tropical skinks and geckoes, provide a physiological explanation of the predilection of Nile monitors for water. It would be interesting to investigate water-loss from non-riverine species of *Varanus* to see to what extent these are better adapted to conserve moisture through transpiration.

It is now generally recognized that activity rhythms represent self-sustained oscillations that are free-running under constant conditions (Pittendrigh & Bruce, 1957) and have their own inherent frequency which approximates to 24 hours—hence the term 'circadian', derived from the Latin *circa* and *dies* (Halberg, 1959). Under natural conditions, circadian rhythms of activity are synchronised with or entrained to the period of the earth's rotation by means of periodic factors of the environment. Of these factors, light is undoubtedly the most important (Cloudsley-Thompson, 1961). Experiments with many species of animal have shown that, with increasing intensity of illumination, the circadian period is shortened in day-active animals and lengthened in nocturnal forms (Aschoff, 1963). In this way, circadian rhythms can be shifted to compensate for seasonal changes in day length. No such effects are apparent, however, in the activity records of *V. niloticus* which in this

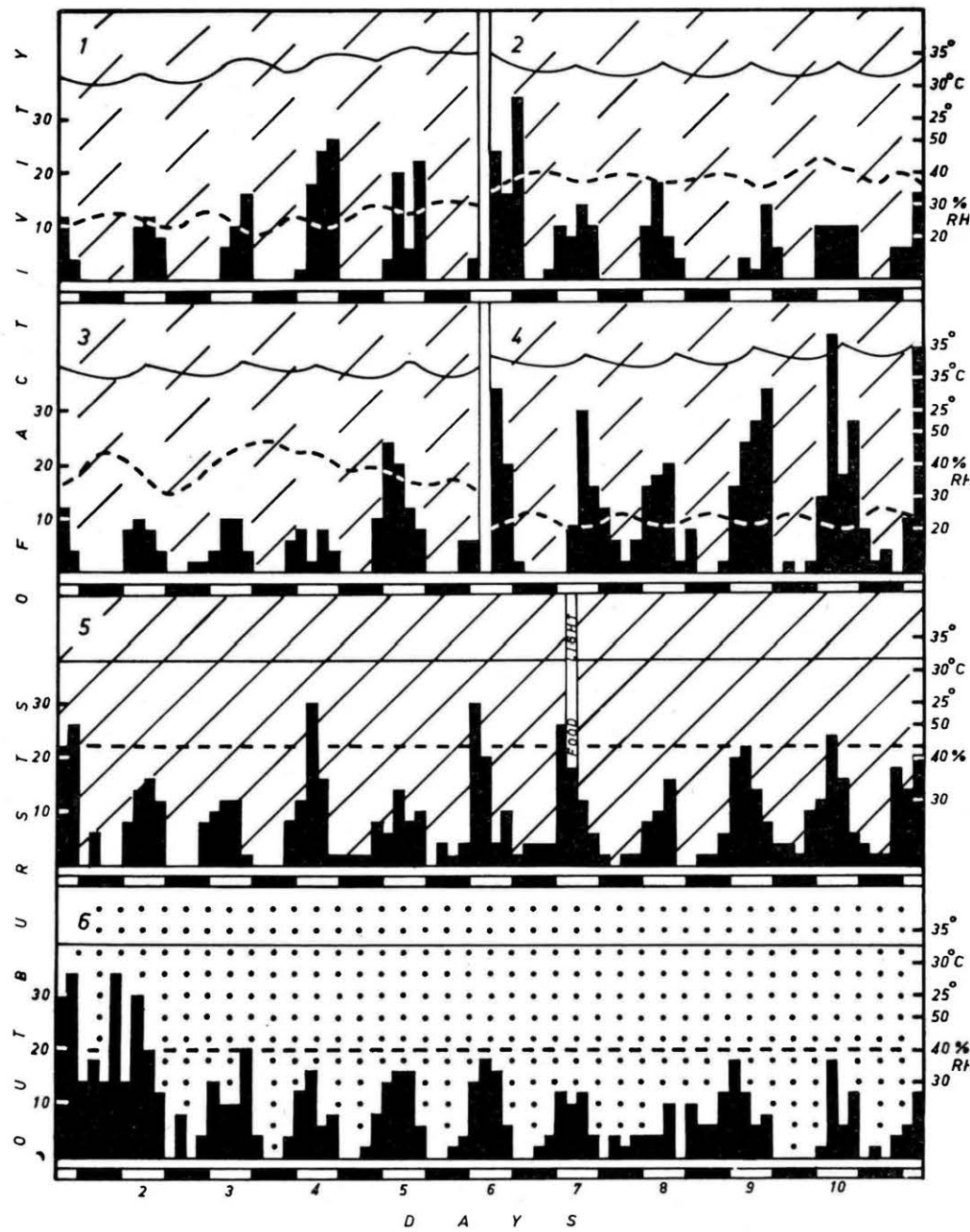

Fig. 1 Nos. 1-6. Rhythmic activity in the Nile monitor. Ordinates: activity on the left, air temperature and relative humidity (broken line) on the right. Abscissa: time in days. The black strips below the histograms represent 12-hour periods from 18.00 to 06.00 hours. 1-3 Sections from typical records of three different animals in natural daylight and darkness. 4. Same of two animals together. 5. Periodicity of two animals in constant darkness. 6. Periodicity of two animals in constant artificial illumination. Further explanation in the text.

respect resembles *Mabuya quinquetaeniatus* and *Tarentola annularis* according to Cloudsley-Thompson (1965). It seems possible that this may be related to the fact that in the tropics where all these reptiles occur there is little annual variation in the length of daylight and such a mechanism may be absent or not very marked.

SUMMARY

The rate of water-loss through transpiration in dry, still air of the Nile monitor lizard at room temperatures (34° ±1°C. range) is about 6 per cent per 24 hours. This is considerably higher than that from tropical skinks and geckoes and accounts for the predilection of monitors for water.

By means of a simple aktograph consisting of a float attached to a needle writing on a kymograph drum, it is shown that monitors are diurnally active throughout the year. The rhythm is endogenous and persists in constant light and darkness but its period is not affected by light intensity.

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NEURAL SPINE EXPANSIONS OF SOME BOID SNAKES

By

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(Received 24/1/66)

Recently Bogert (1964) discussed and figured the vertebrae of several colubrid snakes that had modifications of their neural arches and neural spines. (See Bogert *op. cit.* figs. 16-19 p. 518, figs. 20-25 p. 521, figs. 26-27 p. 523, and figs. 33-35 p. 525). He referred to these modifications as "expansions" and used these as taxonomic characters in the definition of the colubrid genera *Diaphrolepis* Jan and *Synophis* Peracca. He concluded that these expansions have arisen independently in colubrid snakes widely separated geographically, but that ". . . the presence of vertebral expansions may be viewed as evidence of divergence, warranting recognition at the generic level."

In the preparation of a series of skeletons of boid snakes it was noticed that neural spine expansions with the paired anterior extremities mentioned by Bogert were present in several boid species. Since skeletons of boids of diverse habits and from widely separated geographic areas were on hand, it was decided to study these

expansions in available boid species. The genera discussed in the present paper are of the family Boidae as defined by Dowling (1959). These genera will be listed in alphabetical order since Dowling (*op. cit.*) has pointed out that there is a lack of recognizably phyletic subfamilial groupings in boid snakes.

Skeletons of the following boid species were studied: *Boa canina* Linnaeus -1-, *B. enydris* (Linnaeus) -1-, *Charina bottae* (Blainville) -2-, *Chondropython viridis* (Schlegel) -2-, *Constrictor constrictor* (Linnaeus) -7-, *Epicrates angulifer* Bibron -2-, *E. cenchris* (Linnaeus) -3-, *E. inornatus* (Reinhardt) -1-, *E. striatus* (Fischer) -1-, *Eryx johni* Russell -2-, *Eunectes murinus* (Linnaeus) -1-, *Lichanura roseofusca* Cope -1-, *Loxocemus bicolor* Cope -1-, *Morelia spilotes* (Lacepede) -2-, *Sanzinia madagascariensis* (Dumeril and Bibron) -1-, *Tropidophis melanurus* (Schlegel) -1-, and *T. pardalis* (Gundlach) -1-.

The boid vertebral column may be divided into two regions; the *caudal* region where the vertebrae have extra paired lateral projections, the lymphapophyses, and the *precaudal* region where the vertebrae lack lymphapophyses. The precaudal region may be further subdivided into two subregions in most boid genera; a rather short *anterior precaudal* subregion where the vertebrae bear single ventral projections called hypapophyses and a longer *posterior precaudal* subregion where the vertebrae lack hypapophyses. Two boid genera that were not available for the present study (*Casarea* and *Bolyeria*) are reported to have hypapophyses on all of their precaudal vertebrae (Dowling *op. cit.*). The following boid species were found to have expansions on at least some of their vertebrae.

Boa canina.—In a complete specimen the expansions are poorly developed (fig. 1a) and occur on a relatively small number of vertebrae. Their distribution is as follows: anterior precaudals 31(25 without), posterior precaudals 44 (97 without), caudals 0 (65 without).

Charina bottae.—In a complete specimen there are moderately well-developed neural spine expansions (fig. 1b) that occur on a rather large number of vertebrae. These were distributed as follows: anterior precaudals 5 (30 without) posterior precaudals 137 (37 without), caudals 32 (6 without). In addition the specimen has massive neural spine expansions (fig. 1f) on 19 caudal vertebrae. In a series of seven vertebrae from the posterior precaudal subregion of the vertebral column of a second specimen of *C. bottae* there are no neural spine expansions.

Chondropython viridis.—Two complete specimens have striking neural spine expansions (fig. 1c). By manipulating articulated vertebrae in the larger specimen it was determined that if the body were bowed upward the paired anterior extremities of the neutal spines would articulate with the posterior edges of the next vertebrae, but that if the body were bowed downward the neural spines would become disarticulated. The distribution of expansions in the larger specimen is as follows: anterior precaudals 46 (18 without), posterior precaudals 162 (11 without), caudals 0 (75 without). The distribution of the expansions in the smaller specimen is as follows: anterior precaudals 37 (27 without), posterior precaudals 131 (37 without), caudals 2 (38 without).

Epicrates angulifer.—Two complete specimens have moderately developed neural spine expansions. Their distribution in a large specimen is as follows: anterior precaudals 160 (29 without), posterior precaudals 98 (1 without), caudals 45 (5 without). The distribution in a much smaller specimen is as follows: anterior precaudals 17 (80 without), posterior precaudals 86 (101 without), caudals 26 (25 without). It is interesting to note that hypapophyses occur on many more of the precaudal vertebrae of the large specimen than on the precaudal vertebrae of the small one.

Epicrates cenchris.—Poorly developed expansions are present in one of three complete specimens of *E. cenchris*. In this specimen they were present on only one anterior and 31 posterior precaudal vertebrae.

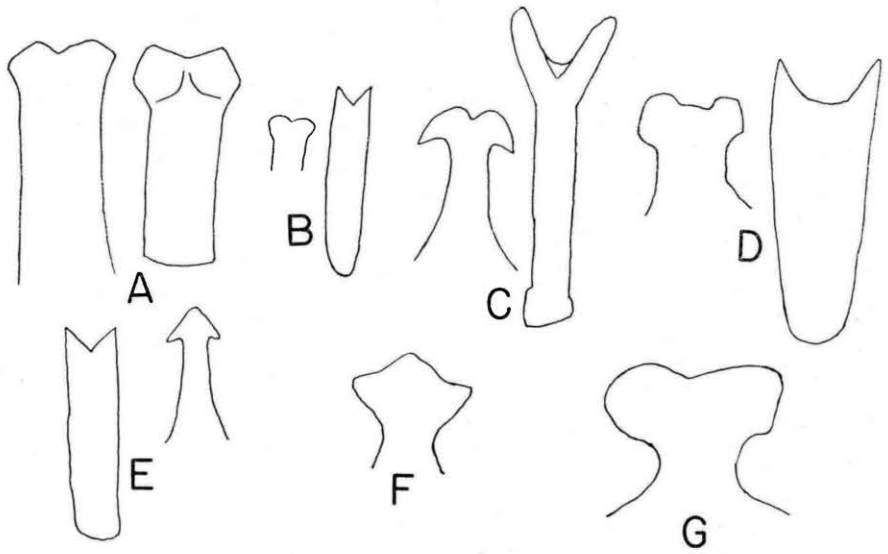

Fig. 1. Neural spines of vertebrae of some boid snakes. A, *Boa canina* (X5); B, *Charina bottae* (X10); C, *Chondropython viridis* (X5); D, *Epicrates inornatus* (X5); E, *Tropidophis melanurus* (X5). A through E, all posterior precaudals, lefts in anterior view, rights in dorsal view. F, *Charina bottae* (X10); G, *Lichanura roseofusca* (X10). F through G, both caudals, both in anterior view.

Epicrates inornatus.—Two posterior precaudal vertebrae that were dissected from an adult specimen have moderately well-developed expansions (fig. 1d). One posterior precaudal vertebra dissected from an *Epicrates striatus* lacked them.

Lichanura roseofusca.— Moderately well developed neural spine expansions are present in a complete specimen. These were distributed as follows: anterior precaudals 11 (50 without), posterior precaudals 153 (20 without), caudals 0 (44 without). As in *Charina bottae*, the *Lichanura* specimen has massive neural spine expansions (fig. 1g). These occur on 24 caudal vertebrae.

Tropidophis melanurus.—In seven anterior precaudal vertebrae dissected from a specimen of *T. melanurus* there are moderately well-developed expansions (fig. 1e). Thirteen precaudal vertebrae dissected from a small *T. pardalis* lacked neural spine expansions.

DISCUSSION AND SUMMARY

Skeletons of 17 species representing 12 genera of boid snakes were studied to determine the occurrence of vertebral neural spine expansions. Expansions of two types were found: (1) the type with anterior paired extremities and that is found on both precaudal and caudal vertebrae, and (2) the massive type that occurs only on caudal vertebrae. The first type was found on five genera and eight species of the boid snakes studied, whereas the second was found only in two genera of small boid snakes restricted to western North America.

Bogert (*op. cit.*) indicated that vertebral expansions could be viewed as evidence of generic divergence in the colubrid genera that he studied. But in the family Boidae I would advise much caution in the use of neural spine expansions as taxonomic characters. There was intracolumnar variation in the presence or absence of neural spine expansions in every specimen having them and there was individual

variation in the presence or absence of them in *Charina bottae* and *Epicrates cenchris*. Moreover, the possibility of ontogenetic and sexual variation exists, although neither of these variations were demonstrated in the present report.

In the two complete specimens of *Chondropython viridis* the neural spine expansions were so strikingly well-developed, and of such regular occurrence along the posterior precaudal part of the vertebral column that I suspect these expansions are genetically stable and that they may represent valid taxonomic characters.

It is presently a matter of speculation whether or not the massive neural spine expansions of the caudal vertebrae of *Charina* and *Lichanura* indicate a close phyletic relationship between the two. This is because these expansions form a significant part of the skeleton of the blunt tail that occurs in both genera. Such a tail seems a highly adaptive feature that could easily be a product of convergent evolution. The neural spine expansions of the caudal vertebrae of *Charina* and *Lichanura* become larger and larger toward the posterior end of the tail. Finally, the terminus of the tail is composed of several ankylosed vertebrae, united in part by fusion of their massive neural spines.

It is interesting to note that the skeleton of the blunt tail of *Eryx johni* has a much different structure. In *Eryx* the posterior caudals are weirdly elaborated by a reticulum of bone around the centrum and neural arch. This reticulum greatly increases the size of the posterior caudal vertebrae. As in *Charina* and *Lichanura* the last few caudals are ankylosed.

I wish to thank Mr. Gene Hartz of the Lincoln Park Zoological Gardens, Chicago, Illinois, and Dr. George Rabb of the Chicago Zoological Society, Brookfield, Illinois for the gift of specimens used in this study.

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SOME OBSERVATIONS OF THE HERPETOFAUNA OF CORSICA

by

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(Received 30/3/66)

The island of Corsica is best known as being the birthplace of Napoleon. Formerly under Italian rule it has now come to be under French legislation.

Corsica is situated in the western Mediterranean between Europe and North Africa and is flanked to the north by France, to the east by Italy and to the south by the island of Sardinia.

The vegetation is of particular interest to botanists on account of the large number of endemic species that are included in its flora: 150 out of a total of 2,000 are confined to the island or only otherwise to be found on Sardinia or the Balearic islands.

The reptile and amphibian population, comprising a total of 18 species, is large relative to the small size of the island and represents elements in the herpetofauna of the land masses surrounding it.

Since the Tertiary age, many earth movements have taken place in the western Mediterranean due to the tectonic cycle of events leading up to the formation of the Alps. During the early Tertiary, a land mass incorporating the island of Corsica included Spain, Italy and other islands of the western Mediterranean and part of North Africa from Morocco to Tunisia. Reptiles and amphibians were present in this area at that time and made up the basic species that are to be found throughout the western area of the Mediterranean today.

Due to the tectonic movements of the Alps, the sea has transgressed many times resulting in the Corsican fauna having affinities with France, Spain, Italy and Sicily, and in particular Sardinia, to which Corsica was connected by a land bridge as late as the Quaternary age just before the onslaught of glaciation. These two islands have several common species of reptiles and amphibians (as well as plants), which are confined to them and which probably evolved *in situ*.

The Ice Age did not have the same devastating effect on the distribution of the reptiles and amphibians of Corsica as it did on their distribution in northern Europe, but caused those species that are now found at high altitudes to be confined to lower levels. The passages of 80 glaciers, that primarily sculptured the mountains to their present form, have been observed in the highest mountains. These would have been detrimental to hibernation.

At the present time the climate consists of long, hot and dry summers with temperatures ranging from 70° to 90°F., while the winters are cool and wet with temperatures from 40° to 60°F. The island is subjected to winds that blow violently at intervals throughout the year; the Mistral roars down the Rhone Valley and together with the biting Tramontana from central Europe brings cold from the north, while the Sirocco from North Africa, blowing at intervals throughout the year, brings warm dry air from the south-east.

It would be expected that animals so affected by cold as reptiles and amphibians, would have their general distribution on the island influenced by temperature.

The range of altitude in Corsica is considerable and rising from the hot, dry coastal plain the higher altitudes give rise to a damper, colder climate, while snow remains at 6,500 feet throughout the year on the mountains in the centre of the island.

The geology of the western and southern part of the island consists primarily of plutonic granite but to the extreme southernmost tip, at the Cape of Bonifacio, the rock is of Miocene limestone, abrupted against the granite to form an interesting geological feature. The geology of the island has little effect on the reptiles directly but does affect the vegetation amongst which they live, while calcareous regions are not well favoured by amphibians.

Mertens (1961) has carried out work on the reptiles and amphibians of Corsica, and Meyer (1963) has made some observations in the north of the island around Calvi. The observations of the present work are confined approximately south of a line running across the island from Ajaccio in the west to Solenzara in the east. They were carried out during the course of a botanical expedition to Corsica in June 1964.

The distribution of the reptiles and amphibians in Corsica is primarily divided by the 1,000 feet level, a definite set of species occurring above and below it. Moisture is a further factor which influences the distribution of a species.

Below 1,000 feet:

Dry habitats:

The species in this habitat are made up of reptiles. A specimen of *Tarentola m. mauritanica* was observed among the rafters of a ruined shack on the limestone cliffs of Bonifacio just above the sea. In the same locality climbing up the rocks making up the fortress, several remarkable lizards, possibly of the introduced species

Lacerta sicula cetti? were seen. The cliffs are very arid, exposed to wind and with sparce vegetation providing little shelter, but with many cracks and crevices in which the lizards seek refuge. *Lacerta t. tiliguerta* was to be seen everywhere in drier habitats and is particularly abundant on the coastal plain to the S.E. of the island. The lizard was often seen basking in clearings of the *Maquis*, the vegetation covering the hillsides rising from the coast and growing luxuriantly on the siliceous soils. A very common snake inhabitating dry hillsides among other habitats, although never far from water, is the whip snake *Coluber v. viridiflavus*. It is very vicious, biting and hissing vigorously when captured, and possesses a striking dark olive background colour with paler flecks scattered over the back. The species is quite ubiquitous occurring at high altitudes, in damp lowland situations or even seeking refuge in dry walls near the coast. It occurs wherever lizards, mainly *L.t. tiliguerta* that make up its food, are to be found.

Wet habitats:

In almost every pond below 1,000 feet, *Rana esculenta* could either be seen or heard. At the particular time of the year (June) many full grown larvae occur in ponds. Individual specimens may occur at greater altitudes and one large female was found in a stream near L'Ospidale at 3,000 feet. It is particularly common in ponds near the coast, leaping rapidly into the brackish water on being disturbed. A single individual of the pond tortoise *Emys orbicularis* was observed floating in the middle of a pond near Porto-Vecchio that was primarily inhabitated by *R. esculenta* whose larvae, no doubt, provide the animal with food. Near by in a damp meadow a single, large female specimen of *Testudo hermanni robertmertensi* was seen. Two lizards were seen in this locality, *Lacerta sicula campestris* and the ubiquitous *L. t. tiliguerta* that quickly disappears into bushes on human intrusion. It was also near this pond that the only recording of *N. natrix corsa*, which was observed gliding into a pile of sticks at great haste, was made. In a similar habitat of bramble bushes growing by a swamp occupied by *R. esculenta*, a specimen of *Coluber v. viridiflavus* was observed, basking on a bush but rapidly disappearing on being disturbed.

Above 1,000 feet:

Dry habitats:

The active little lizard—*Lacerta t. tiliguerta* was seen basking on rocks almost everywhere up to 5,000 feet, above which level it becomes scarce. Where the lizard is present, *Coluber v. viridiflavus* is also found, and one individual was observed amongst scrub and rocks, which make up the mountain sides at 5,000 feet, gliding into the former burrow of a rodent. The splendid lizard—*L. b. bedriagae*, which runs actively over large boulders seeking refuge beneath them and thence reappearing again, occurs locally. This lizard is grey-green with large dark patches on its back and blue lateral scutes and is up to eight inches long. A few specimens were seen above a ravine at 3,000 feet on Mt. Renoso and at 4,000 feet on Mt. d'Oro near Vizzavone in the centre of the island.

Wet habitats:

The most abundant amphibian to be found, beneath boulders in every fast stream running over granite at heights of from 3000 to 5000 feet, is the Corsican mountain newt—*Euproctus montanus*. It is warty and olive brown in colour growing to a length of four inches. Several adult newts were found in a stream running through a pine forest near L'Ospidale at 3,000 feet. They swim from under rocks when they are disturbed and are easily captured. They are very sensitive to warmth and cannot survive temperatures above 65°F for very long. Juveniles were found at altitudes as low as 2,000 feet. Two dead individuals of the Corsican fire salamander—*S. salamandra corsica* were found at 3,500 feet near the beech wood probably from which they had strayed. Juveniles of the painted frog—*Discoglussis pictus sardus* were seen at 3,000 feet in a stream passing through a chestnut forest, but at a greater altitude of 5,000 feet adults were observed basking by the side of small, brown pools filled with submerged and floating aquatic plants in acid mountain bog, into which they leap on being disturbed. At 2,000 feet, just above Ajaccio, young adults and fully developed larvae of *Bufo v. viridis* were seen in a pool of a mountain stream.

The list below shows those species recorded and their general distribution against the check list of amphibians and reptiles of Corsica (Steward (1963), after Mertens).

Amphibia.

Caudata
Salamandridae
Euproctus montanus. Common in streams at high altitudes. Confined to Corsica.
S. salamandra corsica. Occurs in damp woodland at 3,000 feet emerging at night.

A Corsican subspecies.

Salientia
Discoglossidae
Discoglossus pictus sardus. Common in pools on mountain bog. A subspecies also occurring in Sardinia and some Tyrrhenian islands.

Bufonidae
Bufo v. viridis. In streams at 2,000 feet. (Larvae in June).
Hylidae
Hyla arborea sarda. Not recorded.
Ranidae
Rana esculenta. Common in pools below 1,000 feet.

Reptiles.

Testudines
Emydidae
Emys orbicularis. One record only below 1,000 feet.
Testudinidae
Testudo hermanni robertmertensi. One record only below 1,000 feet. A subspecies also occurring in Sardinia, the Balearic islands, Southern France and Spain.

Sauria
Gekkonidae
?Hemidactylus t. turcicus. Not recorded.
Phyllodactylus europaeus. Not recorded.
Tarentola m. mauritanica. One record. By the coast at Bonifacio.
Lacertidae
Algyroides fitzingeri. Not recorded.
Lacerta b. bedriagae. Occurring locally at 3,000-4,000 feet in the centre of the island. A subspecies, also occurring on Sardinia.

L. sicula campestris. Occurs on the coastal plain.
L. sicula cetti? Seen on the fortress of Bonifacio by the coast.
Introduced subspecies, also occurring in Western Sicily, Sardinia, and one or two Tyrrhenian islands.

L. t. tiliguerta. Very common from the coast up to 3,000 feet, becoming scarce at 5,000 feet. Ubiquitous. A subspecies, also occurring on Sardinia, Monte Christo and Caprera.

Serpentes
Colubridae
Coluber v. viridiflavus. Common from the coast up to 3,000 feet, becoming scarce at 5,000 feet. Ubiquitous.

? Coronella girondica. Not recorded.
Natrix natrix corsa. One record below 1,000 feet. A subspecies, only otherwise found on Sardinia.

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A PRELIMINARY SURVEY OF THE REPTILES OF THE IBADAN AREA

By
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Received 21/4/66

INTRODUCTION

The material for this survey of the reptiles of the Ibadan area was collected whilst the writer worked at the University of Ife, 1964-66.

The survey deals with the reptiles of the environs of Ibadan, defined as within a six miles radius of the University campus.

HABITATS

The overall area is usually classified as derived savanna, meaning that savanna tends to replace forest wherever human interference is dominant.

FOREST

Forested belts still remain, as for example the Biological Garden of the University of Ife, being some twenty acres in area.

THICKETS

Thickets occur as a transitional stage between farm and forest.

OPEN AREAS

Ibadan has a golf course and the Universities of Ife and Ibadan, which share a common boundary fence, both have large recreational areas.

TEAK PLANTATIONS, COCOA FARMS

Both occur in the area.

AQUATIC ENVIRONS

Eileyele Reservoir, adjoining the Ife campus, offers a habitat to aquatic and semi-aquatic species, as does a large artificial lake situated in the campus of the University of Ibadan.

GARDENS

The residential suburbs of Ibadan have gardens consisting of lawns, shrubs, fruit trees etc., offering micro-habitats to a number of species.

HOUSES

The verandas, porches and rooms of local houses are frequented by at least one species of lizard.

INSELBERG

There is one small inselberg in the area and several rock outcrops.

CLIMATE

December, January and February are rainless months influenced by the Harmattan, the wind from the Sahara. During the day the temperature may rise to 40°C. (104°F.) and during the night drop to 18°C. (65°F.).

March, April and May are months of increasing storms.

June and July are wet months.

August, September, October and November are months of occasional storms which gradually diminish with the advance of the dry season.

SPECIMENS

Some of the reptiles recorded are preserved in the Zoology Department Museum, of the University of Ife, some are in the writer's private collection. Many were kept alive, for behaviour studies, and some were sent to Zoological collections in other countries.

ACKNOWLEDGEMENTS.

The writer wishes to acknowledge the co-operation of his colleagues at the University of Ife, and the various zoologists and non-zoologists from the University of Ibadan, who kindly (often bravely) caught reptiles which appeared in their gardens, houses and departments.

The author's present address is: 41, Charnwood Avenue, Westone, Northampton.

FAMILY SPECIES	FREQUENCY	FOREST	THICKETS	OPEN AREAS	TEAK PLANTATIONS COCOA FARMS	AQUATIC ENVIRONS	GARDENS	HOUSES	INSELBERG
LEPTOTYPHLOPIDAE Leptotyphlops bicolor									
Leptotyphlops brevicaudata	Four records, all from termite mounds.								
BOIDAE Python regius	Three records					★			
COLUBRIDAE *Aglypha*									
Natriciteres variegatus	Common	★	★		★				
Natriciteres olivaceus	Common					★			
Boaedon fuliginosus	Common			★			★		
Boaedon lineatus	Common			★			★		
Lycophidium irroratum	Two records	★							
Mehelya poensis	Three records	★	★						
Philothamnus heterodermus	Two records		★						
Gastropyxis smaragdina	Common	★	★				★		
Thrasops occidentalis	One record	★							
Grayia smythi	One record					★			
Dasypeltis scabra	Two records				★				
Opisthoglypha Boiga blandingi	Common	★	★				★		
Boiga pulverulenta	Common	★	★				★		

FAMILY SPECIES	FREQUENCY	FOREST	THICKETS	OPEN AREAS	TEAK PLANTATIONS COCOA FARMS	AQUATIC ENVIRONS	GARDENS	HOUSES	INSELBERG
COLUBRIDAE *Opisthoglypha* Crotophopeltis hotamboeia	Occasional						★		
Psammophis sibilans	Common			★			★		
Thelotornis kirtlandi	Three records		★				★		
Dispholidus typus	One record	★							
ELAPIDAE *Proteroglypha* Naja melanoleuca	Common			★			★		
Naja nigricollis	Common	★	★	★			★		
Dendraspis jamesonii	Common	★	★				★		
VIPERIDAE Causus rhombeatus	Common			★			★		
Bitis gabonica	Common					★			
Atractaspis irregularis	One record	★							
AGAMIDAE Agama agama	Common		★	★			★	★	★
GEKKONIDAE Ancylodactylus spinicollis	Common	★							
Hemidactylus brookii	Common							★	
Hemidactylus fasciatus	Occasional	★							
Lygodactylus conrayi	Fairly Common		★					★	

FAMILY SPECIES	FREQUENCY	FOREST	THICKETS	OPEN AREAS	TEAK PLANTATIONS COCOA FARMS	AQUATIC ENVIRONS	GARDENS	HOUSES	INSELBERG
CHAMAELONIDAE Chamaeleo gracilis	Common		★	★			★		
SCINCIDAE Mabuya blandingi	Common	★	★	★	★		★	★	★
Mabuya perroteti	Occasional			★			★		
Mabuya quinquetaenia	Common								★
Riopa fernandi	Two records	★							
VARANIDAE Varanus niloticus	Common					★			
TESTUDINIDAE Kinixys erosa	Common	★							
Kinixys homeana	Common	★							
PELOMEDUSIDAE Pelusius subniger	Occasional The above where they	three are	species sold as	are to aphro	found disiac.	★ in the	local	market s	
CROCODYLIDAE Crocodylus niloticus	Occasional					★			

REPRODUCTION OF PYTHON SEBAE.

By

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Received 8/7/66

In the African python, before egg laying there is considerable embryonic development. In one particular specimen an incision was made in its body, six eggs were extracted and compared with those subsequently laid by the same snake. (see Table 1.).

	Unlaid eggs, extracted from the female.	*Laid eggs.*
Total weight of egg	269 g.	256.5g.
Weight of shell	20.5g.	16.2g.
Weight of yolk and albumen	196.5g.	168.3g.
Weight of embryo	52 g.	72 g.
Length of embryo	37cm.	49cm.

Table 1. Average values of various measurements

The average weight (grammes) and length (centimetres) of 10 hatchlings which eventfully emerged from the eggs, were 54g. and 62cm. respectively. The fact that these embryos were only slightly heavier than those removed from the unlaid eggs, is attributed to the greater fluid content of the latter. Likewise, the larger weights of the shell, yoke, and albumen of the unlaid eggs are due to the same reason.

The 28 eggs laid, were divided into four equal batches.

BATCH 1 was placed in a scooped-out depression, in moist earth contained in a basket, which was then kept in a hole in the ground in a dark moist place.

Temperatures ranged from 72 to 84°F, and Relative Humidities, from 65 to 80%. Five of the seven eggs hatched within 52 days.

BATCH 2 was placed in a basket filled with straw, in a dry sunny place. Temperature ranged from 70 to 90°F. Owing to the low humidity, (less than 40%R.H.), none of the eggs hatched.

BATCH 3 was surrounded by moist soil in a dry sunny place. No eggs hatched.

BATCH 4 was maintained similarly as BATCH 1, but at temperatures of 86 to 90°F, and humidities of 80 to 90% R.H. Four eggs hatched within 49 days.

The results show that in the tropics, particularly West Africa, laid eggs of *Python sebae* need not be incubated by the female. A moist atmosphere and high temperature are sufficient to allow further development of the already well-advanced embryo, which hatches in about two months. Hatching time varies with the surrounding temperature and a high humidity is essential for development.

THE DEFENCE SYSTEM OF THE ANURA AGAINST DESICCATION

By

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The layer between the *stratum spongiosum* and the *stratum compactum*, first seen by Eberth (1869) and redescribed by Kastschenko (1882) is not, as assumed by later authors (Porto, 1936, Radice, 1961) part of the pigmentary reactor system. Examination of 100 salientian species, belonging to 12 of the 14 existing families has shown that this layer is acellular and consists of a mixture of mucopolysaccharides. Taxonomically it is most developed in the most highly differentiated families, particularly the Ranidae and the Microhylidae. Ecologically the layer is extremely scanty or absent in the aquatic, but prominent in the terrestrial species. Histochemically this layer can easily be demonstrated by staining with Alcian Blue 8GX or after Hale (*Nature 157*:802). As a ground substance this layer differs from other similar mucoid deposits by a large admixture of calcium which gives it

an added affinity to haematoxylin. In view of the histochemical nature of this material and its preponderance in those species most exposed to the danger of desiccation, it is assumed that the Kastschenko layer represents a physical buffer system, which takes up water when the frog is submerged and protects it against desiccation when it is temporarily cut off from periodic submersion.

A full account of this investigation will be published elsewhere.

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NEW RECORD LOCALITIES OF AEGEAN AMPHIBIANS AND REPTILES

By

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(*Received* 1/4/66)

During a trip to Greece in the spring of 1963, Mr. Vincent van Laar and the author collected, in addition to many insects and small mammals, about 150 amphibians and reptiles. This collection is preserved in the Zoological Museum of the University of Amsterdam. Several species were collected or observed in islands, which are not included as record localities in Werner's and Wettstein's comprehensive accounts of Aegean herpetology. These new localities are listed below.

Green toad, *Bufo viridis viridis* Laurenti: Salamis (seen near Aiantion, 4.V.1963); Thasos (Sotiros, 18.VII; Prinos, 21.VII).

Tree-frog, *Hyla arborea* (Linnaeus): Thasos (Prinos, 21.VII). The specimens collected at Thasos, in the north of the Aegean Sea, have a granulate throat, and the heels overlap in laterally flexed hindlimbs. Consequently, they show the characters described by Ahl for *Hyla arborea kretensis*. Ahl's description also applies to continental specimens (from Igoumenitsa, Epirus, Greece) in the Zoological Museum in Amsterdam. However, I am not convinced that this form constitutes a good sub-species.

Marsh frog, *Rana ridibunda ridibunda* Pallas. This frog was abundant in wells in the ruins of the old town at Delos (observed 22.VI).

Lacerta peloponnesiaca Bibron & Bory. A specimen of this conspicuously striped lizard was observed near Faneromeni, Salamis (4.V). Unfortunately, it could not be collected. This is the more disappointing, as the species was hitherto considered to be endemic to the Peloponnesos.

Green lizard, *Lacerta trilineata*. Two specimens were collected, at Salamis and at Samos, and were afterwards identified by Prof. Dr. O. von Wettstein (Vienna), which we gratefully acknowledge: *Lacerta trilineata trilineata* Bedriaga: Salamis (Faneromeni, 4.V); *Lacerta trilineata galatiensis* Peters: Samos (Pyrgos, 9.VI).

Ablepharus kitaibelii kitaibelli Bibron & Bory: Salamis (Faneromeni, 4.V); Samos (Pyrgos, 27.V).

Coluber najadum dahlii Schinz: Samos (Pyrgos, 24.V).

Telescopus fallax fallax (Fleischmann): Samos (Pyrgos, 29.V), Delos (23.VI).

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RECTIFICATIONS TO: J. F. D. FRAZER, "HERPETOLOGICAL NOTES ON RHODES"

Brit. Journ. of Herpetology, Vol. 3, Dec. 1965, pp. 220-224

By

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(*Received* 21/4/66)

Through not knowing the detailed literature on the amphibians and reptiles of Rhodes (see Calabresi 1923, Zavattari 1929, Werner 1938 and 1942, Tortonese 1948, Wettstein 1953, Mertens 1959) Frazer has named various reptiles and amphibians wrongly and this should be rectified.

The Green Lizard, which Frazer calls *Lacerta viridis meridionalis* on page 221 and *L. v. trilineata* on pages 222 and 223, is a special form endemic to the island of Rhodes and is named *L. trilineata diplochondrodes* Wettstein. Normally the supraciliary grains are doubled and from this the form can easily be identified. The correct designation of *Mabuya vittata* (?) is *M. aurata fellowsii* (Gray) and *Rana esculenta* is correctly *R. ridibunda*. *Hyla savignyi* is not found nearer than South-East Asia Minor; the tree-frog from Rhodes—as is the case with all tree-frogs from the Aegean Islands—contrary to the mis-statement by Nieden in "Tierreich" 1923 is considered as *Hyla arborea*, probably a separate form *H.a. kretensis* Ahl. The southern arc of the Aegean Islands formed by Crete, Carpathos and Rhodes is known for the fact that no viperids exist there. The *Vipera ammodytes meridionalis* mentioned by Frazer on page 223 could most likely have been *Coluber ravergieri nummifer* Reuss. Nevertheless, the inhabitants of Rhodes call the harmless but beautifully-patterned Leopard Snake *Elaphe situla* L. "Vipera" and believe it to be highly venomous.

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SLOW-WORM EATING LIZARD

By

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(*Received* 31/5/66)

H. Ashley Best (*Brit. J. Herpetol.*, 1965, **3,** 229) reports an adult slow-worm eating an adult common lizard in captivity. I have observed a similar occurrence, the lizard again being swallowed head first; the swallowing process took at least a quarter of an hour. The sharp, recurved teeth of *Anguis*, which are so effective in holding its usual slimy prey of worms and slugs, seem surprisingly formidable; one wonders if it occasionally feeds on lizards and other small vertebrates in the wild.

NEW BOOKS AND JOURNALS

The Tuatara, Lizards and Frogs of New Zealand. By Richard Sharell (*Collins, London*, 1966, 94 pp., 52 colour and 18 black and white photographs, 30/-). A beautifully illustrated semi-popular account of New Zealand herpetology. A. d'A.B.

International Turtle and Tortoise Society Inc. of 8847 De Haviland Ave., Los Angeles, California, published in September 1966, a bi-monthly Journal—for the conservation of turtles and tortoises of the world. Photographs, news and items of scientific interest are included, for all who are interested in Chelonia. H.F.

Krankheiten und Schadigungen der Fische. (Diseases and Debilities of Fishes). By Prof. Dr. H. H. Reichenbach-Klinke (*G. Fischer, Stuttgart*, pp. 389 with 2 colour plates. Price DM 74) 1966.

The world-wide shortage of food reserves is sharpening the general interest in maintaining the health and numbers of any fish suitable for human consumption. Professor Reichenbach-Klinke's book gives a good account of the knowledge we have so far acquired of the diseases and the parasites which may attack and deplete fish living in ponds, lakes, rivers or the sea. The first chapter deals with the general principles of fish pathology, the second with infectious diseases, the third with fungi and algae, the fourth with protozoa, the fifth with coelenterates, the sixth with helminths, the seventh with crustaceans, the ninth with tumours, the tenth with noxious environmental causes damaging to fish. Most useful to English-speaking users of the book will be the glossaries, the first of which lists the more

important edible fish and their parasites, the second the names of these fish in German, Latin, English, French and Italian, while the third gives again the English names and their German equivalents. The book is supplied with 330 illustrations and two colour plates. For those commanding a sufficiently advanced knowledge of German this book will be an indispensable reference volume to the present day knowledge and the literature on fish diseases, replacing the classic 'Scaperclaus', which has for too long remained out of print. E. Elkan.

The Frogs of South Africa. By Vincent A. Wager (*Purnell, Cape Town*, 1965), 242 pp., 209 photographs (82 in colour), many drawings. R.12.50 (6 gns.). "Frogs" in the title means frogs and toads. Parts 1 and 3 give a broad range of general information; parts 2, 4 and 5 classify and describe the 101 species and subspecies of tail-less amphibians found in South Africa, including their eggs and tadpoles, with data on distribution, ecology and behaviour. A lot of detailed information, much of it first hand, is interestingly presented. Most of the many photographs are good, some of them superb. Expensive, but otherwise recommended. J. W. Steward.

In the June, 1966 Issue of this Journal a notice appeared concerning an "Illustrated Guide to the Venomous Snakes of Hong Kong", by J. D. Romer: published by Government Printer, Hong Kong, 1965. Copies of this attractive booklet are obtainable from the London Office of the Hong Kong Government, 54 Pall Mall, London, S.W.1. The price is 4/6d. post free in the U.K.

THE SCIENTIFIC USE OF B.B.C. WILDLIFE SOUND RECORDINGS

At present a complete set of all the B.B.C. recordings is deposited in the Sub-department of Animal Behaviour, High Street, Madingley, Cambridge (enquiries to Professor W. H. Thorpe) and at the headquarters of the British Trust for Ornithology, Beech Grove, Tring, Herts. (enquiries to the secretary). In addition all insect recordings are deposited with the Department of Entomology at the British Museum (Natural History) (enquiries to Dr. D. R. Ragge), but these cannot be sent out on loan. New records are automatically sent to these centres as they become available. The British Institute of Recorded Sound is planning to purchase a further set from the B.B.C. and this will be available for study in London (at the B.I.R.S., 29 Exhibition Road, London, S.W.7.).

All the B.B.C. recordings are on disc; the old 12-inch 78 rpm ones are now being systematically transferred to 7-inch 33⅓ rpm discs. The English and scientific names of each species are clearly stated on the labels, plus the type of vocalization, the place, month and year of recording, and the name of the recordist. In the case of recordings made in the British Isles, the recording details on the label are limited to the county, month and year for space reasons (e.g. Devon, August, 1964); for those made abroad the details given usually refer to the state, province or other similar area, the country and the month and year (e.g., Oost. Flevoland, Holland, June, 1963 or Tasmania, November, 1961). However, more precise details are available; indeed, every recording is as fully documented as possible and the information is kept on a card index in the Sound Archives Library in Broadcasting House, London. Duplicates of this index are kept in my office at Broadcasting House, Bristol. Where recordings have been heavily edited (e.g., to reduce long natural intervals between vocalizations), this is now being indicated on the label.

I shall be glad to supply, if possible, additional information about any recording in the collection on request.

J. F. Burton
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Brackets denote sketch figures and plates.